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## (57) Abstract

**SUBJECT** Absorption of the jitter of the real time transmission signal transmitted via packet networks, such as IP with many jitters, is made easy, and the time delay which jitter absorption takes is oppressed.

**Means for Solution** Are a means to store time stamp CR for RTP and an MPEG-2 system layer in the same DEJITTA buffer 13 11, means to calculate the time TCd according to the accumulated dose 19 of the DEJITTA buffer 13 15, and DEJITTA buffer's read-out side, and CR and time TCd are carried out comparison 17. When in agreement, it has a means 18 to control read-out.

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## Claim(s)

**Claim 1A** signal receiving set comprising:

A means to store in the same buffer memory a time stamp signal which transmits time information of the transmitting side, and a real time signal in a signal receiving set which receives a real time signal which went via a packet network.

A means to recover a clock and time information of the transmitting side according to an accumulated dose of a buffer memory.

A means which is a buffer memory's read-out side, and reads a real time signal from said buffer memory when said time stamp is compared with recovered time information and it is in agreement.

**Claim 2** The signal receiving set comprising according to claim 1:

A means for a means to recover a clock and time information of said transmitting side to compare a threshold value beforehand determined as an accumulated dose of said buffer memory, and to ask for difference.

A means which multiplies said difference by the dignity 1 when it is beyond said threshold value which an accumulated dose of a buffer memory defined beforehand, and multiplies by big dignity by said difference when it is less than said threshold value which an accumulated dose of FAMEMORI defined beforehand.

A means by which a value which smoothed a value which multiplied difference by dignity to a time direction recovers said clock.

**Claim 3** In a signal receiving method which receives a real time signal which went via a packet network, A time stamp signal and a real time signal which transmit time information of the transmitting side are stored in the same buffer memory, A signal receiving method which a clock and time information of the transmitting side are recovered according to an accumulated dose of a buffer memory, and is a buffer memory's read-out side, and is characterized by reading a real time signal from said buffer memory when said time stamp is compared with recovered time information and it is in agreement.

**Claim 4** Recovery of a clock of said transmitting side compares a threshold value beforehand determined as an accumulated dose of said buffer memory, and it asks for difference, When it is beyond said threshold value which an accumulated dose of a buffer memory defined beforehand, said difference is multiplied by the dignity 1, The signal receiving method according to claim 3 carrying out by recovering said clock with a value which smoothed a value which multiplied by big dignity by said difference, and multiplied difference by dignity to a time direction when an accumulated dose of FAMEMORI is less than said threshold value defined beforehand.

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## Detailed Description of the Invention

### 0001

**Field of the Invention** This invention relates to a signal receiving set and a signal receiving method, and is a real time signal especially.

. Although the picture and voice coding signal on condition of transmitting at a fixed speed are general-purpose, the time of arrival becomes early, or become late. When transmitted to packet networks, such as IP what is called with many jitters, it is related with the signal receiving set and signal receiving method which attain jitter oppression and minimization of a time delay and receive the signal in a receiver.

### 0002

**Description of the Prior Art** There are a fixed-length-coding system which various systems are known as conventional technology about the coding mode of a picture, for example, assigns fixed code word length to every of a picture signal one sample point (pixel), and a variable-length-coding system which assigns the symbolic language of variable length. Although the composition becomes complicated, since the variable length coding can assign the symbolic language of the optimal length according to the occurrence probability of a

phenomenon, it can shorten average code word length intrinsically, and can improve transmission efficiency. For this reason, variable length coding is adopted widely.

**0003** However, since variable length coding differs in the code word length for every screen, it needs to take the synchronization of a screen with the transmitting side and a receiver. For this reason, the transmitting side acquires the value of the time information called STC for example, in a cycle of 100 ms, and is transmitting it to the receiver as time information (time stamp) called PCR. A receiver recovers time STC using transmitted time stamp PCR, and is decrypting the picture and the audio signal. Calculate at a counter using the system clock of the frequency beforehand determined as recovery of time STC by the receiver, and time STC is created, It is fluctuating and controlling the frequency of the above-mentioned system clock as compared with this time STC and time stamp PCR which received, so that this comparison is in agreement.

**0004** Since the above-mentioned system clock is used for the whole decoding device, image display is also prescribed by this system clock. When a system clock shifts more nearly substantially than regular frequency, it becomes impossible for this reason, for a picture monitor to display an image. When changing a system clock a comparatively short cycle, even if the deviation width itself is small, the clock which the voltage controlled oscillator for a color-difference-signal recovery of a picture monitor generates may answer the change, and may stop changing and turning off, and disturbance of color unevenness occurring may produce it.

**0005** Since time stamp PCR also arrives by a small jitter when a jitter uses few ATM networks and leased line networks as a transmission line, as for a receiver, a system clock and time STC are easily recoverable. However, so that clearly also from the generation method of the above-mentioned system clock a receiver, . Change sharply, without protecting the cycle of the above-mentioned **the receipt time of time stamp PCR sent out with a constant period** . When there are many what is called jitters, comparison with PCR and time STC of PCR arrival time which were mentioned above cannot be performed correctly, but right recovery of a system clock or time STC becomes difficult. That is, as mentioned above, the problem of it becoming impossible to display an image with a picture monitor, and color unevenness occurring arises.

**0006** The cause which a jitter generates with a packet network is as follows. Since it is made for the purpose of transmitting the data of non-real time certainly, the packet network is constituted so that data may be transmitted burstily, only when there is data. That is, there is equipment called a router etc. in the network node which constitutes a packet network, and once this router stores the received signal in the memory in a router, only when it is possible to transmit to a network, it transmits that signal. For this reason, how much period accumulation of is carried out for each data with a router etc. has change. When the data which actually flows as compared with transmission capacity increases in number, the problem in a router which delay not only increases on the whole, but a jitter increases since you make it wait each other and time increases arises.

**0007** As conventional technology (the 1st conventional technology) for solving the above-mentioned problem, the technology indicated for "the 1st example of H.222.0 Annex J.2 of ITU advice" is known, for example. Before the 1st conventional technology indicated to this advice receives above-mentioned time stamp PCR in a receiver, It is the method of reading data from FIFO with constant speed so that data may be once stored in FIFO (buffer memory **First In First Out / buffer memory** ) and the accumulated dose of FIFO may be satisfied by the constant rate (for example, half). Since the accumulated dose of FIFO will also be changed if change of the arrival speed of the received signal, i.e., a jitter, is large, this method must be changed in the reading speed from FIFO corresponding to change of an accumulated dose. Therefore, like a packet network, when the jitter of an input signal is extremely large, since the reading speed from FIFO is also changed corresponding to it, this method is difficult **when / of an ATM network etc. / there are comparatively few jitters it can apply, but to apply.**

**0008** Generally, MPEG-2 decoding device makes this reading speed a standard, decoding processing is performed, and the display to a picture monitor is also performing this speed as a standard. As everyone knows, the picture monitor cannot reproduce a color, if the subcarrier frequency which transmits the color-difference signal of the picture signal to display shifts from about 200-300 ppm and frequency:3.5795MHz of regulation. Therefore, when it has a big jitter in a reading speed, a jitter arises also in the output image signal to the picture monitor using it, subcarrier frequency shifts from default value, and there is a possibility that it may become impossible to reproduce a chrominance signal exceeding the drawing-in range of a picture monitor.

**0009** The technology similarly indicated for "the 2nd example of H.221.0 Annex J.2 of ITU advice" as other conventional technologies (the 2nd conventional technology) which can solve a problem which was mentioned above is known. This 2nd conventional technology is because the following procedures are performed.

**0010** (1) Network adaptation layer (in an IP network.) RTP: The system called Real Time Protocol sets to be applied and extracts the time for RTP called TC from the time stamp called CR given to the RTP layer by technology, such as PLL (Phased Lock Loop).

**0011** (2) Calculate the time TCd by reducing time ( $J/2$ ;, however J are the peak two peak values of a jitter) required in order to absorb a jitter from this time TC.

**0012** (3) It separates into an MPEG-2 system layer and above-mentioned CR, and the data received via the packet network is stored in a DEJITTA buffer and a jitter removal control circuit, respectively.

**0013** (4) A jitter removal control circuit reads the signal of the MPEG-2 system layer corresponding to this CR, when the time TCd generated above (2) is compared with CR accumulated and it is in agreement.

**0014** (5) MPEG-2 decoding device generates the system clock for a decoding, and time STC from time stamp PCR in an MPEG-2 system layer, and performs a normal decoding.

**0015** (6) Thereby, the big jitter by a packet network can be absorbed and a normal receiving set can be

constituted.

**0016**The block diagram and drawing 6 in which the composition of IP signal receiving set by the 2nd conventional technology mentioned above is shown are a block diagram showing the composition of the time recovery circuit in drawing 5, and these figures explain drawing 5 about conventional technology hereafter. In drawing 5 and drawing 6, IP signal receiving set and 11 6 A network transport packet decoding circuit, A network data packet decoding circuit and 13 12 A DEJITTA buffer, 14 -- a write address (WA) counter and 15 -- a time (TC) recovery circuit and 16 -- as for a counter and 32, a jitter removal control circuit and 18 are a **smoothing circuit and 34** voltage controlled oscillators a comparison circuit and 33 a read address (RA) counter and 31 a difference circuit and 17.

**0017**In the signal receiving set 6 shown in drawing 5, the received packet signal, Only the signal which should be received is received by the network transport packet decoding circuit 11, the header of the packet of the transport layer, etc. are removed, and network data are transmitted to the network data packet decoding circuit 12. The network data packet decoding circuit 12 decomposes a packet, extracts time stamp CR for RTP, and writes time stamp CR in the time recovery circuit 15 and the jitter removal control circuit 17, and it writes an MPEG-2 system layer signal in the DEJITTA buffer 13. The writing address of the DEJITTA buffer 13 is prescribed by the WA counter 14.

**0018**The time recovery circuit 15 recovers time stamp CR to time TC. In order to oppress the underflow of the DEJITTA buffer 13 by a jitter, the difference circuit 16 generates the time TCd which subtracted from TC value  $J/2$  which multiplied the peak two peak value of the jitter by one half, and was delayed for TC, and notifies the time TCd to the jitter removal control circuit 17.

**0019**The jitter removal control circuit 17 stores time stamp CR, is delayed synchronizing with the corresponding MPEG-2 system layer signal accumulated in the DEJITTA buffer 13, and compares the time TCd. If both are in agreement, the MPEG-2 system layer signal which carries out stepping of the read address counter 18, and corresponds from the DEJITTA buffer 13 will be read.

**0020**The signal receiving set 6 shown in drawing 5 which operates as mentioned above, Since the value of time TC synchronizes with time TC of the transmitting side, after giving transmitting side time stamp CR, an MPEG-2 system layer signal can be read from the DEJITTA buffer 13 after a fixed time delay ( $J/2$ ), and a jitter can be removed theoretically. Even if the system clock recovered by the receiver has a jitter a little, if the picture monitor which displays an MPEG-2 system layer signal and which is not illustrated is the drawing-in tolerance level of a color-difference signal, it can perform the display which is satisfactory in image quality.

**0021**The time recovery circuit 15 in the above-mentioned signal receiving set 6 is constituted as shown in drawing 6. And the counter 31 is initialized by the value of CR given from the network data packet decoding circuit 12, and the value of CR and the value of the counter 31 which were given whenever CR was given are henceforth compared by the comparison circuit 32. After the comparison result is smoothed by the smoothing circuit 33, it is inputted into the voltage controlled oscillator 34, and a clock is recovered. This clock is inputted into the counter 31 and carries out stepping of the counter value. This clock synchronizes with the clock which generates CR at the transmitting side mostly, and it operates so that the value of the counter 31 may also be mostly in agreement with the value of the counter which generates CR at the transmitting side. Not thoroughly in agreement, CR is because the time lag of the transmission time in the transmitting side and the arrival time in a receiver does not become fixed by a jitter etc. The time recovery circuit 15 can reproduce the clock and time of the transmitting side almost correctly in a receiver by the above-mentioned.

**0022**The 2nd conventional technology mentioned above is reproducing the clock called CR to TC which did not reproduce a read clock directly from the residue of FIFO, but received. TC is 90 kHz irrespective of access speed or its jitter. The clock of the transmitting side which is generating CR is also 90 kHz, and since this value is generated from a camera signal, the frequency precision of a camera signal can be guaranteed. Usually, it is known that the accuracy of accuracy of a camera signal is very as high as about  $\pm 10$  ppm. Then, it also becomes possible to become possible **the clock of a receiver**, if it is set, for example as about  $\pm 100$  ppm to synchronize with the clock of the transmitting side with sufficient margin, and to suppress the drawing-in range of the clock of a receiver in the drawing-in range of a picture monitor.

**0023**

**Problem to be solved by the invention**Although what is depended on the 2nd conventional technology mentioned above can oppress a jitter better rather than the thing of the 1st conventional technology, Since time stamp CR for RTP and the signal of the MPEG-2 system layer were independently considered as storing, management becomes complicated and small economization of equipment has the problem of being difficult. Since CR is sent out at equal intervals at the transmitting side, the 2nd conventional technology is comparatively easy for CR which CR reaches to also become at equal intervals mostly, and to reproduce TC from here, when a jitter is applied to few nets like an ATM network, but. Since arrival of CR becomes an unequal interval when a jitter is applied to a large net like a packet network, reproducing CR to TC will need a logical operation complicated naturally, and the problem that the circuit structure becomes large is produced.

**0024**Since the 2nd conventional technology mentioned above deducted  $J/2$  from TC as a value which absorbs a jitter and the MPEG-2 system layer corresponding to each CR is read, When  $J/2$  is changed dynamically, absorb, stop going out a jitter and a DEJITTA buffer carries out an underflow, and a transmission error arises, or, Or the purpose of this invention of having the problem that an MPEG-2 system layer signal may be greatly delayed by giving the big absorptance more than needed, The jitter produced when transmitting real time signals, such as a picture encoding signal, with a packet network is oppressed in a receiver, and it is in providing the signal receiving set and signal receiving method which can attain minimization of a time delay and can be received.

**0025**

**Means for solving problem** In the signal receiving set which receives the real time signal with which said purpose went via the packet network according to this invention, A means to store in the same buffer memory the time stamp signal which transmits the time information of the transmitting side, and a real time signal, It is attained by being a means **to recover the clock and time information of the transmitting side according to the accumulated dose of a buffer memory**, and buffer memory's read-out side, and having a means which reads a real time signal from said buffer memory, when said time stamp is compared with the recovered time information and it is in agreement.

**0026** Namely, a means to specifically store in the DEJITTA buffer as time stamp CR for RTP, and an MPEG-2 system layer with same this invention, It has a means to calculate the time TCd according to the accumulated dose of a DEJITTA buffer, and a means which are DEJITTA buffer's read-out sides, and reads a DEJITTA buffer when CR is compared with the time TCd and it is in agreement, and is constituted.

**0027**

**Mode for carrying out the invention** Hereafter, Drawings explain the embodiment of the signal receiving set by this invention in detail.

**0028** Drawing 1 is a block diagram showing the system configuration of the whole which transmits real time signals, such as a picture and an audio signal, with a packet network, and explains the system configuration which transmits first real time signals with which this invention is applied, such as a picture and an audio signal, with a packet network with reference to drawing 1. in drawing 1 -- 1 -- a camera and 2 -- a microphone and 3 -- as for a signal receiving set and 7, a packet signal transmission apparatus and 5 are **a picture monitor and 9** loudspeakers a picture speech decoding device and 8 a packet network and 6 a picture voice to digital converter and 4.

**0029** In the system shown in drawing 1, it is coded by the picture voice to digital converter 3, and after the audio signal collected with the picture signal picturized with the camera 1 or the microphone 2 is changed into the form that it is suitable for an IP network with a packet signal transmission apparatus, it is outputted to the packet network 5. After the packet signal receiving set 6 receives the packet signal transmitted from the IP transmission network 5 and transforms it inversely in a suitable form, it transmits the signal to the picture speech decoding device 7. The picture speech decoding device 7 restores a picture signal and an audio signal in a procedure contrary to the coding in the picture voice to digital converter 3, and outputs them to the picture monitor 8 or the loudspeaker 9.

**0030** The block diagram showing the composition of the signal receiving set according **drawing 2** to one embodiment of this invention, the figure with which drawing 3 explains change of the data accumulation amount in a DEJITTA buffer, and drawing 4 are the block diagrams showing the composition of the time recovery circuit in drawing 2. in drawing 2 and drawing 4 -- 19 -- an accumulated dose calculating machine and 21 -- as for a multiplication circuit and 25, a positive/negative judgment circuit and 23 are **a voltage controlled oscillator and 27** counters an equalizing circuit and 26 a switch and 24 a difference circuit and 22, and the mark of a terminal is the same as that of the case of drawing 5.

**0031** In the signal receiving set 6 by one embodiment of this invention shown in drawing 2, received IP signal, Like the case of the conventional technology explained by drawing 5, the packet header of the transport layer is removed by the network transport packet decoding circuit 11, and it is generated by the network data packet. This network data packet is directly written in the DEJITTA buffer 13. A writing address is prescribed by the WA counter 14.

**0032** The accumulated dose of the DEJITTA buffer 13 with which the accumulated dose calculating machine 19 calculated the difference of the WA counter 14 and the RA counter 18 is inputted into the time recovery circuit 15. And the speed of a system clock is controlled and the time recovery circuit 15 is reproduced so that the value which carried out the time average of the accumulated dose of the DEJITTA buffer 13 may turn into a fixed value, and it generates the time TCd of a receiver from the system clock. That is, when the average value of the accumulated dose of the DEJITTA buffer 13 increases, in order to carry out a reading speed early, the time recovery circuit 15 speeds up a system clock, carries out TCd early, conversely, when the average value of an accumulated dose decreases, makes a system clock late and makes TCd overdue.

**0033** Although the time recovery circuit 15 of the point which generates a system clock from an accumulated dose of the embodiment of this invention mentioned above is the same as that of the case of the 1st conventional technology explained by the above-mentioned, the frequency of a system clock is synchronized with the system clock of the transmitting side in the embodiment of this invention. That is, since it is known that the system clock frequency of the transmitting side is stable to about \*\*10 ppm, the control range of the system clock frequency of a receiver can be limited to about \*\*100 ppm like the case of the 2nd conventional technology explained by drawing 5. Therefore, the jitter of the picture signal generated from such a system clock can also be oppressed to \*\*200 ppm - 300 ppm or less which can reproduce a color-difference signal, and can perform a normal display.

**0034** Initialization of the time recovery circuit 15 is performed as follows. That is, when empty reading is performed and CR is detected until the DEJITTA buffer 13 detects time stamp CR at the time of initialization of the time recovery circuit 15, read-out is stopped there. Next, when the accumulated dose of the DEJITTA buffer 13 becomes the value defined beforehand, read-out of the DEJITTA buffer 13 is started, and the value of CR is written in the time recovery circuit 15, and the time recovery circuit 15 is initialized.

**0035** The network data packet decoding circuit 12, Extract CR from the network data packet read from the DEJITTA buffer 13 by the RA counter 18, and notify to the jitter removal control circuit 17, and. The headers of

a network data packet are deleted and an MPEG-2 system layer signal is transmitted to the picture speech decoding device 7 shown in drawing 1.

**0036**The jitter removal control circuit 17 compares TCd with CR, when in agreement, it carries out stepping of the RA counter 18, and it reads the DEJITTA buffer 13.

**0037**Operation equivalent to the case of the 2nd conventional technology is realizable in a easier circuit by providing the signal receiving set by the embodiment of this invention with the composition mentioned above, and performing processing operation which was mentioned above.

**0038**The embodiment of this invention mentioned above can decrease the time delay of a signal by the method explained below from having the feature of using an accumulated dose in generation of TCd, absorbing a jitter.

**0039**That is, when an accumulated dose is beyond a threshold value, an absolute value of difference of an accumulated dose and a threshold value is added, and an absolute value of said difference is subtracted and it may be made to smooth as a valuation function at the time of time TCd recovery at the time of less than a threshold value. In this case, as shown in drawing 3 (a), even if a jitter is large and it is small, an average time delay becomes fixed. On the other hand, in order to lessen an accumulated dose as much as possible, as shown in drawing 3 (b), A comparatively small threshold value is set up, and when an accumulated dose is beyond this threshold value, an absolute value of difference of an accumulated dose and this threshold value is added, and after multiplying an absolute value of difference of a threshold value and an accumulated dose by big dignity N, it may subtract and equalize at the time of less than this threshold value. Area of a field in which less than a threshold value becomes becomes small, so that dignity N (N is good also as about ten to 100 value, for example) is large, since a ratio with area of a field which becomes area of a field where a time delay becomes larger than a threshold value, and the following becomes a reciprocal of the above-mentioned dignity.

Therefore, it comes to illustrate change of an accumulated dose at the time of attaching dignity to drawing 3 (b), and when there is little jitter width, an accumulated dose can decrease and a time delay can be decreased. When a jitter is large, the minimum of an accumulated dose is hardly changed, but average value becomes large. A time delay is increased automatically by this and underflow in the DEJITTA buffer 13 can be prevented.

**0040**The DEJITTA buffer 13 may set the threshold value mentioned above as the minimum value that does not cause an underflow within limits a jitter is assumed to be.

**0041**Next, an example of the time recovery circuit 15 with the circuit which changes dignity by the positive/negative of the difference of the above-mentioned threshold value and an accumulated dose, and is equalized is explained with reference to drawing 4.

**0042**The accumulated dose of the DEJITTA buffer 13 which is the difference of the WA counter 14 and the RA counter 18 is calculated with the accumulated dose calculating machine 19 by the time recovery circuit 15, and the result is inputted into it. As shown in drawing 4, the time recovery circuit 15 is provided with the switch 23, the multiplication circuit 24, the equalizing circuit 25, the voltage controlled oscillator 26, and the counter 27 which choose the difference circuit 21, the positive/negative judgment circuit 22, and dignity, and is constituted.

**0043**In the time recovery circuit 15 shown in drawing 4, the difference circuit 21 calculates difference of an accumulated dose of the DEJITTA buffer 13 inputted, and a threshold value. Positive/negative is judged by the positive/negative judgment circuit 22, this calculated difference depends by that result, and "1" or a big value "N" is chosen by the switch 23 as dignity. An output of the difference circuit 21 can be multiplied by selected dignity by the multiplication circuit 24, it is smoothed by the equalizing circuit 25, and is inputted into a control terminal of the voltage controlled oscillator 26. The voltage controlled oscillator 26 makes frequency of a system clock fluctuate corresponding to voltage of a control terminal. This system clock is given to the counter 27 and the counter 27 carries out time TCd generation. Therefore, this time TCd becomes early according to an accumulated dose of the DEJITTA buffer 13, or is controlled to become late.

**0044**If a value of dignity mentioned above is set to "1" at this time, it will become simple equalization as shown in drawing 3 (a).

**0045**The embodiment of this invention explained by the above-mentioned stores in the same buffer memory time stamp CR which transmits the time information of the transmitting side, and the real time signal which coded the picture etc., Although the clock and time information of the transmitting side were recovered according to the accumulated dose of this buffer memory, it was a buffer memory's read-out side, and explained having read the real time signal when above-mentioned time stamp CR was compared with the recovered time information and it was in agreement, This invention can also change so that it may explain below.

**0046**That is, it may be made for this invention to give a number in order to a packet as a measure against packet loss. For example, there is a protocol called Real Time Protocol (henceforth RTP) in MPEG over IP, and a sequence number is given for every packet. Since that sequence number received when packet discarding was carried out becomes discontinuous by a parity error etc. even if a packet does not arrive or it arrives, the method by this protocol can detect packet loss and abandonment.

**0047**In what uses the protocol mentioned above, if there is abandonment of packet loss or a packet, the accumulated dose of the DEJITTA buffer 13 will decrease, and the embodiment of this invention mentioned above will be performed so that the control to the time recovery circuit 15 may serve as a direction which makes a system clock frequency late superfluously. In order to prevent this, when this invention detects abandonment of packet loss or a packet by the above-mentioned, The false signal equivalent to the packet lost and discarded is written in the DEJITTA buffer 13 of the address equivalent to an applicable packet number, and when reading from the DEJITTA buffer 13, it can avoid affecting an accumulated dose by deleting a false signal.

**0048**Although the embodiment of this invention controlled by the above-mentioned was described as reception of a signal to an MPEG-2 system signal, this invention is applicable to the signal reception in the system which transmits the arbitrary real time signals which have a time stamp.

**0049**Since **according to the embodiment of this invention mentioned above** the real time signal and time stamp CR of MPEG-2 system data etc. are stored in the same buffer memory, it becomes easy to take correlation between those signals, and control of signal reception can be made easy. Since the time of a receiver is recovered using the accumulated dose of a buffer memory according to the embodiment of this invention, It becomes possible to attain minimization of the accumulated dose of the signal to a buffer memory in the range which can absorb a jitter, and the time delay by a buffer can be oppressed to necessary minimum.

**0050**

**Effect of the Invention**As explained above, according to this invention, the jitter produced when transmitting a real time signal with a packet network is oppressed in a receiver, and minimization of a time delay can be attained and it can receive.

**Field of the Invention**This invention relates to a signal receiving set and a signal receiving method, and it is a real time signal especially, . Although the picture and voice coding signal on condition of transmitting at a fixed speed are general-purpose, the time of arrival becomes early, or become late. When transmitted to packet networks, such as IP what is called with many jitters, it is related with the signal receiving set and signal receiving method which attain jitter oppression and minimization of a time delay and receive the signal in a receiver.

**Description of the Prior Art**There are a fixed-length-coding system which various systems are known as conventional technology about the coding mode of a picture, for example, assigns fixed code word length to every **of a picture signal** one sample point (pixel), and a variable-length-coding system which assigns the symbolic language of variable length. Although the composition becomes complicated, since the variable length coding can assign the symbolic language of the optimal length according to the occurrence probability of a phenomenon, it can shorten average code word length intrinsically, and can improve transmission efficiency. For this reason, variable length coding is adopted widely.

**0003**However, since variable length coding differs in the code word length for every screen, it needs to take the synchronization of a screen with the transmitting side and a receiver. For this reason, the transmitting side acquires the value of the time information called STC for example, in a cycle of 100 ms, and is transmitting it to the receiver as time information (time stamp) called PCR. A receiver recovers time STC using transmitted time stamp PCR, and is decrypting the picture and the audio signal. Calculate at a counter using the system clock of the frequency beforehand determined as recovery of time STC by the receiver, and time STC is created, It is fluctuating and controlling the frequency of the above-mentioned system clock as compared with this time STC and time stamp PCR which received, so that this comparison is in agreement.

**0004**Since the above-mentioned system clock is used for the whole decoding device, image display is also prescribed by this system clock. When a system clock shifts more nearly substantially than regular frequency, it becomes impossible for this reason, for a picture monitor to display an image. When changing a system clock a comparatively short cycle, even if the deviation width itself is small, the clock which the voltage controlled oscillator for a color-difference-signal recovery of a picture monitor generates may answer the change, and may stop changing and turning off, and disturbance of color unevenness occurring may produce it.

**0005**Since time stamp PCR also arrives by a small jitter when a jitter uses few ATM networks and leased line networks as a transmission line, as for a receiver, a system clock and time STC are easily recoverable. However, so that clearly also from the generation method of the above-mentioned system clock a receiver, . Change sharply, without protecting the cycle of the above-mentioned **the receipt time of time stamp PCR sent out with a constant period** . When there are many what is called jitters, comparison with PCR and time STC of PCR arrival time which were mentioned above cannot be performed correctly, but right recovery of a system clock or time STC becomes difficult. That is, as mentioned above, the problem of it becoming impossible to display an image with a picture monitor, and color unevenness occurring arises.

**0006**The cause which a jitter generates with a packet network is as follows. Since it is made for the purpose of transmitting the data of non-real time certainly, the packet network is constituted so that data may be transmitted burstily, only when there is data. That is, there is equipment called a router etc. in the network node which constitutes a packet network, and once this router stores the received signal in the memory in a router, only when it is possible to transmit to a network, it transmits that signal. For this reason, how much period accumulation of is carried out for each data with a router etc. has change. When the data which actually flows as compared with transmission capacity increases in number, the problem in a router which delay not only increases on the whole, but a jitter increases since you make it wait each other and time increases arises.

**0007**Conventional technology for solving the above-mentioned problem

**Effect of the Invention**As explained above, according to this invention, the jitter produced when transmitting a real time signal with a packet network is oppressed in a receiver, and minimization of a time delay can be attained and it can receive.

**Problem to be solved by the invention**Although what is depended on the 2nd conventional technology mentioned above can oppress a jitter better rather than the thing of the 1st conventional technology, Since time stamp CR for RTP and the signal of the MPEG-2 system layer were independently considered as storing, management becomes complicated and small economization of equipment has the problem of being difficult. Since CR is sent out at equal intervals at the transmitting side, the 2nd conventional technology is comparatively easy for CR which CR reaches to also become at equal intervals mostly, and to reproduce TC from here, when a jitter is applied to few nets like an ATM network, but. Since arrival of CR becomes an unequal interval when a jitter is applied to a large net like a packet network, reproducing CR to TC will need a logical operation complicated naturally, and the problem that the circuit structure becomes large is produced.

**0024**Since the 2nd conventional technology mentioned above deducted  $J/2$  from TC as a value which absorbs a jitter and the MPEG-2 system layer corresponding to each CR is read, When  $J/2$  is changed dynamically, absorb, stop going out a jitter and a DEJITTA buffer carries out an underflow, and a transmission error arises, or, Or the purpose of this invention of having the problem that an MPEG-2 system layer signal may be greatly delayed by giving the big absorptance more than needed, The jitter produced when transmitting real time signals, such as a picture encoding signal, with a packet network is oppressed in a receiver, and it is in providing the signal receiving set and signal receiving method which can attain minimization of a time delay and can be received.

**Means for solving problem**In the signal receiving set which receives the real time signal with which said purpose went via the packet network according to this invention, A means to store in the same buffer memory the time stamp signal which transmits the time information of the transmitting side, and a real time signal, It is attained by being a means **to recover the clock and time information of the transmitting side according to the accumulated dose of a buffer memory**, and buffer memory's read-out side, and having a means which reads a real time signal from said buffer memory, when said time stamp is compared with the recovered time information and it is in agreement.

**0026**Namely, a means to specifically store in the DEJITTA buffer as time stamp CR for RTP, and an MPEG-2 system layer with same this invention, It has a means to calculate the time TCd according to the accumulated dose of a DEJITTA buffer, and a means which are DEJITTA buffer's read-out sides, and reads a DEJITTA buffer when CR is compared with the time TCd and it is in agreement, and is constituted.

**0027**

**Mode for carrying out the invention**Hereafter, Drawings explain the embodiment of the signal receiving set by this invention in detail.

**0028**Drawing 1 is a block diagram showing the system configuration of the whole which transmits real time signals, such as a picture and an audio signal, with a packet network, and explains the system configuration which transmits first real time signals with which this invention is applied, such as a picture and an audio signal, with a packet network with reference to drawing 1. in drawing 1 -- 1 -- a camera and 2 -- a microphone and 3 -- as for a signal receiving set and 7, a packet signal transmission apparatus and 5 are **a picture monitor and 9** loudspeakers a picture speech decoding device and 8 a packet network and 6 a picture voice to digital converter and 4.

**0029**In a system shown in drawing 1, it is coded by the picture voice to digital converter 3, and after an audio signal collected with a picture signal picturized with the camera 1 or the microphone 2 is changed into form that it is suitable for an IP network with a packet signal transmission apparatus, it is outputted to the packet network 5. After the packet signal receiving set 6 receives a packet signal transmitted from the IP transmission network 5 and transforms it inversely in a suitable form, it transmits the signal to the picture speech decoding device 7. The picture speech decoding device 7 restores a picture signal and an audio signal in a procedure contrary to coding in the picture voice to digital converter 3, and outputs them to the picture monitor 8 or the loudspeaker 9.

**0030**A block diagram showing composition of a signal receiving set according **drawing 2** to one embodiment of this invention, a figure with which drawing 3 explains change of a data accumulation amount in a DEJITTA buffer, and drawing 4 are the block diagrams showing composition of a time recovery circuit in drawing 2. in drawing 2 and drawing 4 -- 19 -- an accumulated dose calculating machine and 21 -- as for a multiplication circuit and 25, a positive/negative judgment circuit and 23 are **a voltage controlled oscillator and 27** counters an equalizing circuit and 26 a switch and 24 a difference circuit and 22, and a mark of a terminal is the same as that of a case of drawing 5.

**0031**In the signal receiving set 6 by one embodiment of this invention shown in drawing 2, received IP signal, Like the case of the conventional technology explained by drawing 5, the packet header of the transport layer is removed by the network transport packet decoding circuit 11, and it is generated by the network data packet. This network data packet is directly written in the DEJITTA buffer 13. A writing address is prescribed by the WA counter 14.



**0032**The accumulated dose of the DEJITTA buffer 13 with which the accumulated dose calculating machine 19 calculated the difference of the WA counter 14 and the RA counter 18 is inputted into the time recovery circuit 15. And the speed of a system clock is controlled and the time recovery circuit 15 is reproduced so that the value which carried out the time average of the accumulated dose of the DEJITTA buffer 13 may turn into a fixed value, and it generates the time TCd of a receiver from the system clock. That is, when the average value of the accumulated dose of the DEJITTA buffer 13 increases, in order to carry out a reading speed early, the time recovery circuit 15 speeds up a system clock, carries out TCd early, conversely, when the average value of an accumulated dose decreases, makes a system clock late and makes TCd overdue.

**0033**Although the time recovery circuit 15 of the point which generates a system clock from an accumulated dose of the embodiment of this invention mentioned above is the same as that of the case of the 1st conventional technology explained by the above-mentioned, the frequency of a system clock is synchronized with the system clock of the transmitting side in the embodiment of this invention. That is, since it is known that the system clock frequency of the transmitting side is stable to about  $\pm 10$  ppm, the control range of the system clock frequency of a receiver can be limited to about  $\pm 100$  ppm like the case of the 2nd conventional technology explained by drawing 5. Therefore, the jitter of the picture signal generated from such a system clock can also be oppressed to  $\pm 200$  ppm - 300 ppm or less which can reproduce a color-difference signal, and can perform a normal display.

**0034**Initialization of the time recovery circuit 15 is performed as follows. That is, when empty reading is performed and CR is detected until the DEJITTA buffer 13 detects time stamp CR at the time of initialization of the time recovery circuit 15, read-out is stopped there. Next, when the accumulated dose of the DEJITTA buffer 13 becomes the value defined beforehand, read-out of the DEJITTA buffer 13 is started, and the value of CR is written in the time recovery circuit 15, and the time recovery circuit 15 is initialized.

**0035**The network data packet decoding circuit 12, Extract CR from the network data packet read from the DEJITTA buffer 13 by the RA counter 18, and notify to the jitter removal control circuit 17, and. The headers of a network data packet are deleted and an MPEG-2 system layer signal is transmitted to the picture speech decoding device 7 shown in drawing 1.

**0036**The jitter removal control circuit 17 compares TCd with CR, when in agreement, it carries out stepping of the RA counter 18, and it reads the DEJITTA buffer 13.

**0037**Operation equivalent to the case of the 2nd conventional technology is realizable in a easier circuit by providing the signal receiving set by the embodiment of this invention with the composition mentioned above, and performing processing operation which was mentioned above.

**0038**The embodiment of this invention mentioned above can decrease the time delay of a signal by the method explained below from having the feature of using an accumulated dose in generation of TCd, absorbing a jitter.

**0039**That is, when an accumulated dose is beyond a threshold value, the absolute value of the difference of an accumulated dose and a threshold value is added, and the absolute value of said difference is subtracted and it may be made to smooth as a valuation function at the time of time TCd recovery at the time of less than a threshold value. In this case, as shown in drawing 3 (a), even if a jitter is large and it is small, an average time delay becomes fixed. On the other hand, in order to lessen an accumulated dose as much as possible, as shown in drawing 3 (b), A comparatively small threshold value is set up, and when an accumulated dose is beyond this threshold value, the absolute value of the difference of an accumulated dose and this threshold value is added, and after multiplying the absolute value of the difference of a threshold value and an accumulated dose by big dignity N, it may subtract and equalize at the time of less than this threshold value. The area of the field in which less than a threshold value becomes becomes small, so that dignity N (N is good also as about ten to 100 value, for example) is large, since the ratio with the area of the field which becomes the area of the field where a time delay becomes larger than a threshold value, and the following becomes a reciprocal of the above-mentioned dignity. Therefore, it comes to illustrate change of the accumulated dose at the time of attaching dignity to drawing 3 (b), and when there is little jitter width, an accumulated dose can decrease and a time delay can be decreased. When a jitter is large, the minimum of an accumulated dose is hardly changed, but average value becomes large. A time delay is increased automatically by this and the underflow in the DEJITTA buffer 13 can be prevented.

**0040**The DEJITTA buffer 13 may set the threshold value mentioned above as the minimum value that does not cause an underflow within limits a jitter is assumed to be.

**0041**Next, an example of the time recovery circuit 15 with the circuit which changes dignity by the positive/negative of the difference of the above-mentioned threshold value and an accumulated dose, and is equalized is explained with reference to drawing 4.

**0042**The accumulated dose of the DEJITTA buffer 13 which is the difference of the WA counter 14 and the RA counter 18 is calculated with the accumulated dose calculating machine 19 by the time recovery circuit 15, and the result is inputted into it. As shown in drawing 4, the time recovery circuit 15 is provided with the switch 23, the multiplication circuit 24, the equalizing circuit 25, the voltage controlled oscillator 26, and the counter 27 which choose the difference circuit 21, the positive/negative judgment circuit 22, and dignity, and is constituted.

**0043**In the time recovery circuit 15 shown in drawing 4, the difference circuit 21 calculates the difference of the accumulated dose of the DEJITTA buffer 13 inputted, and a threshold value. Positive/negative is judged by the positive/negative judgment circuit 22, this calculated difference depends by that result, and "1" or a big value "N" is chosen by the switch 23 as dignity. The output of the difference circuit 21 can be multiplied by the selected dignity by the multiplication circuit 24, it is smoothed by the equalizing circuit 25, and is inputted into

the control terminal of the voltage controlled oscillator 26. The voltage controlled oscillator 26 makes the frequency of a system clock fluctuate corresponding to the voltage of a control terminal. This system clock is given to the counter 27 and the counter 27 carries out time TCd generation. Therefore, this time TCd becomes early according to the accumulated dose of the DEJITTA buffer 13, or is controlled to become late.

**0044**If the value of the dignity mentioned above is set to "1" at this time, it will become simple equalization as shown in drawing 3 (a).

**0045**The embodiment of this invention explained by the above-mentioned stores in the same buffer memory time stamp CR which transmits the time information of the transmitting side, and the real time signal which coded the picture etc., Although the clock and time information of the transmitting side were recovered according to the accumulated dose of this buffer memory, it was a buffer memory's read-out side, and explained having read the real time signal when above-mentioned time stamp CR was compared with the recovered time information and it was in agreement, This invention can also change so that it may explain below.

**0046**That is, it may be made for this invention to give a number in order to a packet as a measure against packet loss. For example, there is a protocol called Real Time Protocol (henceforth RTP) in MPEG over IP, and a sequence number is given for every packet. Since that sequence number received when packet discarding was carried out becomes discontinuous by a parity error etc. even if a packet does not arrive or it arrives, the method by this protocol can detect packet loss and abandonment.

**0047**In what uses the protocol mentioned above, if there is abandonment of packet loss or a packet, the accumulated dose of the DEJITTA buffer 13 will decrease, and the embodiment of this invention mentioned above will be performed so that the control to the time recovery circuit 15 may serve as a direction which makes a system clock frequency late superfluously. In order to prevent this, when this invention detects abandonment of packet loss or a packet by the above-mentioned, The false signal equivalent to the packet lost and discarded is written in the DEJITTA buffer 13 of the address equivalent to an applicable packet number, and when reading from the DEJITTA buffer 13, it can avoid affecting an accumulated dose by deleting a false signal.

**0048**Although the embodiment of this invention controlled by the above-mentioned was described as reception of a signal to an MPEG-2 system signal, this invention is applicable to the signal reception in the system which transmits the arbitrary real time signals which have a time stamp.

**0049**Since **according to the embodiment of this invention mentioned above** the real time signal and time stamp CR of MPEG-2 system data etc. are stored in the same buffer memory, it becomes easy to take correlation between those signals, and control of signal reception can be made easy. Since the time of a receiver is recovered using the accumulated dose of a buffer memory according to the embodiment of this invention, It becomes possible to attain minimization of the accumulated dose of the signal to a buffer memory in the range which can absorb a jitter, and the time delay by a buffer can be oppressed to necessary minimum.

### Brief Description of the Drawings

**Drawing 1**It is a block diagram showing the system configuration of the whole which transmits real time signals, such as a picture and an audio signal, with a packet network.

**Drawing 2**It is a block diagram showing the composition of the signal receiving set by one embodiment of this invention.

**Drawing 3**It is a figure explaining change of the data accumulation amount in a DEJITTA buffer.

**Drawing 4**It is a block diagram showing the composition of the time recovery circuit in drawing 2.

**Drawing 5**It is a block diagram showing an example of the composition of the signal receiving set by conventional technology.

**Drawing 6**It is a block diagram showing the composition of the time recovery circuit in drawing 5.

### Explanations of letters or numerals

- 1 Camera
- 2 Microphone
- 3 Picture voice to digital converter
- 4 Packet signal transmission apparatus
- 5 Packet network
- 6 Signal receiving set
- 7 Picture speech decoding device
- 8 Picture monitor
- 9 Loudspeaker
- 11 Network transport packet decoding circuit
- 12 Network data packet decoding circuit
- 13 DEJITTA buffer
- 14 Write address (WA) counter
- 15 Time (TC) recovery circuit
- 16 and 21 Difference circuit
- 17 Jitter removal control circuit
- 18 Read address (RA) counter

19 Accumulated dose calculating machine  
22 Positive/negative judgment circuit  
23 Switch  
24 Multiplication circuit  
25 Equalizing circuit  
26 Voltage controlled oscillator  
27 Counter  
31 Counter  
32 Comparison circuit  
33 Smoothing circuit  
34 Voltage controlled oscillator

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### **Drawing 1**

For drawings please refer to the original document.

### **Drawing 2**

For drawings please refer to the original document.

### **Drawing 3**

For drawings please refer to the original document.

### **Drawing 5**

For drawings please refer to the original document.

### **Drawing 4**

For drawings please refer to the original document.

### **Drawing 6**

For drawings please refer to the original document.

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For drawings please refer to the original document.

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